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The Three-Factor Eating Questionnaire-R21: A Confirmatory Factor Analysis in a Portuguese sample

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O Questionário de Três Fatores do Comportamento Alimentar (TEFQ-R21): Uma Análise Fatorial Confirmatória na população Portuguesa.

Resumo

Diferentes padrões de comportamento alimentar têm sido associados a resultados distintos em termos de peso, saúde, bem-estar e qualidade de vida. O Questionário de Três Fatores do Comportamento Alimentar (TFEQ) é um dos instrumentos mais utilizados para estudar diferentes comportamentos alimentares, em populações obesas e não obesas. Este mede três tipos de comportamento alimentar nomeadamente: restrição cognitiva, descontrolo alimentar e alimentação emocional; que têm sido associados a resultados distintos. O presente estudo tem como objetivo avaliar a estrutura fatorial e a fiabilidade da versão portuguesa do TFEQ-R21, utilizando uma análise fatorial confirmatória (CFA). Adicionalmente, as diferenças de género, para diferentes tipos de comportamento alimentar, foram também exploradas.

A amostra incluiu 468 participantes da população geral, 67,1% do sexo feminino e 32,9% do sexo masculino, com idades entre os 18 e os 60 anos. Os resultados da CFA confirmaram a estrutura de três fatores do TFEQ e o modelo revelou um ajustamento adequado (GFI=.91, CFI=.94, TLI=.93, RMSEA=.06). Os resultados da análise multi-grupos confirmaram a invariância factorial para o género. Além disso, todas as três dimensões apresentaram boas propriedades psicométricas. No que diz respeito às diferenças de género, as mulheres reportaram pontuações mais altas na ingestão emocional e restrição cognitiva do que homens. Para o descontrolo alimentar não foram encontradas diferenças significativas para o género.

Em geral, os resultados suportam que, a versão portuguesa do TFEQ é um instrumento útil, fiável e robusto para avaliar comportamentos alimentares.

Palavras-chave: TFEQ-R21; Análise Fatorial Confirmatória (AFC); ingestão emocional; restrição cognitiva; descontrolo alimentar.

The Three-Factor Eating Questionnaire-R21: A Confirmatory Factor Analysis in a Portuguese sample

Abstract

Eating behaviors are associated with different weight and health-related outcomes as well as one's overall well being and quality of life. The Three-Factor Eating Questionnaire (TFEQ) is one of the most widely used instruments to study different eating behaviors, in obese and non-obese populations. It measures three types of eating behaviors namely: cognitive restraint, uncontrolled eating and emotional eating; that have been associated with distinct outcomes. The present study aims to evaluate the factor structure and reliability of the Portuguese version of the TFEQ-R21, using a confirmatory factor analysis (CFA). Additionally, gender differences for different types of eating behaviors were also explored.

The sample included 468 participants from the general population, 67,1% female and 32,9% male, with ages ranging from 18 to 60 years old. Results from the CFA confirmed the three-factor structure of TFEQ-R21 and the model revealed an adequate model fit to the data (GFI=.91, CFI=.94, TLI=.93, RMSEA=.06). Multi-group analysis results support the invariance of measurement across genders. Furthermore, all three dimensions presented good psychometric properties. Concerning gender differences, females reported higher scores in emotional eating and cognitive restraint than males. For uncontrolled eating no significant gender differences were found. Overall results support that the Portuguese version of the TFEQ is a useful, reliable and robust instrument to assess eating behaviors.

Keywords: TFEQ-R21; Confirmatory Factor Analysis (CFA); emotional eating; cognitive restraint; uncontrolled eating;

Introduction

Literature has been highlighting the importance of studying distinct types of eating behaviors (e.g., dietary restraint, emotional eating, uncontrolled eating), as they seem to be associated with different weight and health-related outcomes (Anglé et al., 2009; De Lauzon et al., 2004). This seems especially important given the increasing prevalence of obesity and eating and weight-related problems (WHO, 2004).

Although it is especially prevalent in adolescent girls and young women, unhealthy eating behaviors can appear in different forms and severity degrees across different populations, such as clinical and non-clinical, obese and normal weight, different sex and age groups (Hautala et al., 2008; Karlsson, Persson, Sjöström, & Sullivan, 2000). This emphasizes the need of valid and usable instruments applicable to a wide range of populations (e.g., Anglé et al., 2009). Some measures, such as the Restraint Scale (Herman & Polivy, 1975), the Dutch Eating Behavior Questionnaire (Van Strien, Frijters, Bergers, & Defares, 1986) and the Three-Factor Eating Questionnaire (TEFQ; Stunkard & Messick, 1985) are the most widely used instruments to study eating behaviors.

The original Three-Factor Eating Questionnaire contained 51 items and was constructed to evaluate three cognitive and behavioral domains of eating behaviors (cognitive restraint, disinhibition and hunger) in obese populations (Stunkard & Messick, 1985). However, it also proved to be an adequate instrument to use with general populations (Natacci & Ferreira, 2011; Yeomans, Leitch, & Mobini, 2008) and has been translated into different languages and cultures (e.g., Anglé, et al., 2009; De Lauzon et al., 2004; Natacci & Ferreira, 2011). Nevertheless, the original three factor structure of the TEFQ failed to be replicate in subsequent studies (Ganley, 1988; Hyland, Irvine, Thacker, Dann, & Dennis, 1989; Karlsoon et al., 2000).

Therefore, Karlsoon and collaborators (2000), using a large sample of obese middle-aged Swedish participants, developed a revised and shorter version of TEFQ with 18 items. The TEFQ-R18 significantly improved the scale's psychometric properties. Also, evidence of construct validity was found for the cognitive restraint dimension. However, several items from disinhibition and hunger dimensions were grouped and created one global dimension that was named Uncontrolled Eating. Lastly, a new dimension emerged with items reflecting emotional eating (Karlsson et al., 2000). Empirical support has been found for the TEFQ-R18 stable factor structure, and its ability to distinguish between distinct eating patterns, in both obese and non-obese populations (De Lauzon et al., 2004; Elfhag & Linné, 2005). Later, three additional items for the Emotional Eating dimension were added in order to minimize floor and ceiling effects. This new version of the TFEQ (TEFQ-R21) further improved TEFQ'S psychometric properties (Cappelleri et al., 2009; Natacci & Ferreira, 2011; Tholin, Rasmussen, Tynelius, & Karlsson, 2005).

In Portugal only the 51 items version of the TFEQ was adapted, using a sample of healthy college students. This Portuguese version was able to replicate the instruments three-factor structure, although several problems with the items were identified. The final Portuguese version of the TEFQ only retained 26 of the 51 original items and revealed satisfactory psychometric properties (Moreira, Almeida, Sampaio, & Vaz Almeida, 1997).

The TEFQ evaluates three types of eating behaviors - cognitive restraint, uncontrolled eating and emotional eating - that have been associated with distinct outcomes (Anglé et al., 2009; De Lauzon et al., 2004). Cognitive restraint has been one of the most widely researched eating behaviors (Herman & Polivy, 1975). The term restraint, dietary restraint, cognitive restraint or restrained eating are frequently used interchangeably, and refers to the consciously and constantly efforts to restrict food intake in order to achieve a desired

weight (e.g., Anglé et al., 2009).

Given the increasing obesity rate and the easy access to abundant food, it would be expected restrained eating to be an adaptive behavior to foster weight loss (Larsen, Strien, Eisinga, Herman, & Engels, 2007), since has been associated to lower body weight, body mass index, total energy intake and energy expenditure (e.g. McGuire, Jeffery, French, & Hannan, 2011; Tuschl, Platte, Laessle, Stichler, & Pirke, 1990; Westenhoefer, Stunkard, & Pudel, 1999). However, in many prospective studies, restraint has also been linked to binge eating (e.g. Neumark-Sztainer et al., 2006; Taboada et al., 2015) obesity and weight gain (e.g. Field et al., 2003; Stice, Presnell, Shaw, & Rohde, 2005). According to the restraint theory these findings suggest that dieters can be vulnerable to overeating, when cognitive control is disrupted by forbidden food or negative emotions (Herman & Polivy, 1980). An alternative explanation is that individuals attempt to restrict the food intake but fail in their attempts, leading to weight gain (Stice, 2002; Van Strien, Engels, Van Staveren, & Herman, 2006). Finally, it has also been proposed that restrained eaters tend to gain weight because, although they may consume less food than they desired to, this does not mean that the amount is less than they need in order to lose weight (Van Strien et al., 2006).

These findings lead several authors to claim that restrained eating is not the same as dieting (Beiseigel & Nickols-Richardson, 2004; Lowe & Timko, 2004; Lowe, Whitlow & Bellwoar, 1991) and that the instruments that include restraint eating may be assessing the intent to diet and not actual dieting behaviors (Lowe, 1993). Williamson and collaborators (2007) tested the validity of four questionnaires (Three-Factor Eating Questionnaire; Dutch Eating Behavior Questionnaire; Revised Restraint Scale; and Current Dieting Questionnaire) and found that TFEQ was the only one that actually assesses intent to diet and actual caloric restriction.

On the other hand, uncontrolled eating describes the tendency to

overeat as a result of a loss of control over the intake, as well as subjective feelings of hunger (Anglé et al., 2009; Karlsson et al, 2000). Taking into account that individuals are exposed to a high-risk food environment it is expected that, at some extent, they will overeat. However, this behavior is more likely to occur in some individuals than others, and these are more likely to have a higher energy intake and weight gain (Blundell & Cooling, 2000; Blundell et al., 2005; French et al., 2012). The inability to inhibit the food intake, once started, can be linked to difficulties in perceiving satiety cues (French et al., 2014). Several studies found that uncontrolled eating is associated with increased energy intake, fat, consumption of high caloric food and preference for fatty and salty foods (Fogelholm, Kukkonen-Harjula, & Oja, 1999; Garaulet et al., 2012; Keskitalo et al., 2008). Moreover, individuals with high levels of uncontrolled eating tend to present higher BMIs, less success in weight loss attempts and more overeating and binge eating behaviors (e.g., Westenhoefer et al., 1999).

Lastly, emotional eating has been described as a mood regulation strategy, which can result in overeating, in response to dysphoric states, such anxiety, depression, anger and loneliness (e.g., Faith, Allison, & Geliebter, 1997; Saat et al., 2014). Indeed, a growing body of research has shown that emotions play an important role on one's food choices and eating habits (e.g. Macht, Gerer, & Ellgring, 2003; Macht & Simons, 2000). Therefore, food can be used as a mean to alleviate negative emotions, and may occur as a result of a dietary restriction or due to daily live problems (Greeno & Wing, 1994; Oliver & Wardle, 1999). Also, emotional eaters tend to reveal difficulties in distinguishing between psychological states and hunger –satiety signals (Tholin et al., 2005).

Although, initially, emotional eating seems to alleviate undesired internal experiences (e.g. negative affect, shame, self-criticism) it often produces a rebound effect (e.g., Lillis, Hayes &

Levin, 2012), enhancing those negative internal experiences, perpetuating a cycle of dysfunctional eating behaviors (e.g., Wegner et al., 2002). In fact, several studies emphasize that emotional eating has been associated with a higher energy intake, BMI and unhealthy food choices (Anglé et al., 2009; Keskitalo et al., 2008; Konttinen et al., 2010; Van Strien, Herman, & Verheijden, 2009). Furthermore, it has been related to higher levels of shame, distress and psychopathological symptoms (e.g., Karlsoon et al., 2000; Konttinen et al., 2010)

Although the majority of the studies concerning eating behaviors were conducted only with the female population (e.g., Bellisle & Dalix, 2001; Hays et al., 2002; Lähteenmäki & Tuorila, 1995; Oh, Kim & Choue, 2002; Tuschl, 1990) there is some evidence regarding gender differences (Cappelleri et al., 2009; De Lauzon et al., 2004; Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003; Wardle, Griffith, Johnson, & Rapoport, 2000). Women tend to report significantly higher levels of cognitive restraint and emotional eating than men (Boerner, Spillane, Anderson, & Smith, 2004; Jáuregui-Lobera, García-Cruz, Carbonero-Carreño, Magallares, & Ruiz-Prieto, 2014; Provencher et al., 2003). It has been argued that these findings may be due to the fact that women tend to present more weight and body dissatisfaction and engage in more dieting behaviors than men (Keski-Rahkonen et al., 2005; McElhone, Kearney, Giachetti, Zunft, & Martinez, 1999; Serdula et al., 1999; Wardle & Johnson, 2002). Furthermore, in Western societies, achieving a valued physical appearance (thin body) has become a mean to enhance one's social rank, especially for women (Buote, Wilson, Strahan, Gazzola, & Papps, 2011; Gilbert, 2002). Thus having a thin body has been linked not only to being attractive and healthy but it can be also used to feel accepted, valued and to gather positive social attention from others (Ferreira, Pinto-Gouveia, & Duarte, 2013a, 2013b; Gilbert, 2002; Troop, Allan, Treasure, & Katzman, 2003). On the contrary, people

make efforts to avoid having a body type that is different (e.g. overweight) than the valued one as it may put one at risk of being criticized, attacked or rejected by others (Puhl & Heuer, 2009). Together, Furthermore, body dissatisfaction and unfavourable social comparisons have been consistently link to eating psychopathological behaviors (Pinto-Gouveia, Ferreira, & Duarte, 2012; Stice, Marti, & Durant, 2011; Troop et al., 2003) as well as depressive and anxiety symptoms (e.g., Stice, Spangler, & Agras, 2001; Tiggeman & McGill, 2004).

Concerning gender differences for uncontrolled eating research found mixed results (Lesdéma et al., 2012; Chearskul, Pummoung, Vongsaiyat, Janyachailert, & Phattharayuttawat, 2010; Drapeau et al., 2003; Hainer et al., 2006; Löffler et al., 2015). Whereas several studies found that women tend to present higher levels of uncontrolled eating than men (Chearskul et al., 2010; Lesdéma et al., 2012; Löffler et al., 2015), others found higher levels in males (Drapeau et al., 2003; Hainer et al., 2006) or no differences between genders (de Lauzon et al., 2004).

The main purpose of the present study is to conduct a confirmatory factor analysis and evaluate the psychometrics properties of the Portuguese version of the TFEQ-R21, in a sample of the general population. Additionally, it is also intended to explore the factorial invariance of the TEFQ-R21 structure for gender and explore gender differences in eating behaviors. It is expected that the three-factor structure of the TEFQ-R21 will be confirmed. Also the gender invariance of the scale's structure will be tested. Furthermore, women are expected to report significantly higher levels of cognitive restraint and emotional eating than men. Finally, the associations between the three different types of eating behaviors and psychopathological symptoms, shame, self-criticism, self-disgust and eating psychopathological symptoms are also explored.

Materials and Methods

Participants

The sample included 468 participants, 67,1% female (n=314) and 32,9% male (n=154), with ages ranging from 18 to 60 years old. The participants presented a mean age of 32.58 years (*SD*=11,49) and 13.72 (*SD*=3,12) of years of education. The majority of the participants was part of the middle class (37,2%) and 33,5% were students. Concerning marital status 59,8% of the participants were single and 27,8% were married. The participant's BMI mean was 23.63 (*SD*=3.59).

Procedures

The data collected respected ethical principles and the research protocol was approved by the ethical committee of the Faculty of Psychology of the University of Coimbra. Participants were properly informed about the aims of the study as well as the voluntary and its confidential nature. After signing the informed consent participants completed the questionnaire (approximately 20 minutes).

Measures

Demographic Data. Participants were asked about their age, educational level, current height and weight. Then BMI (Wt/Ht^2) was calculated.

Three Factor Eating Questionnaire – Revised21 (TEFQ-R21) **(**Cappelleri et al., 2009; Portuguese version by: Palmeira & Pinto-Gouveia, 2015) is a reduced version of the original questionnaire that comprised 51 items. It is a self-report scale, with 21 items, that measures three domains of eating behavior: cognitive restraint, uncontrolled eating and emotional eating. The first twenty items are

rated on a 4-point Likert scale, where 1 is *completely true* and 4 *completely false*. The item 21 is answered through an 8-point Likert scale (1 - *I eat everything I want and when I want* and 8 - *I constantly confine my food intake*; Karlsson, 2000). The version used in this study (TFEQ-R21) was constructed from the Portuguese version of 51 items (Moreira et al., 1997), the original version of TFEQ (Stunkard & Messick, 1985) and the Brazilian version of 21 items (Natacci & Ferreira, 2011). Several studies confirm that all three subscales present an adequate internal consistency (α = .76 for cognitive restraint, .83 emotional eating and .85 for uncontrolled eating), discriminant and convergent validity (e.g., Bloom, Shelton, Bengough, & Brennanl, 2013).

Forms of Self-Criticizing and Reassuring Scale (FSCRS; Gilbert, Clarke, Hempel, Miles, & Irons, 2004; Portuguese version by: Castilho & Pinto-Gouveia, 2011a). This self-report scale assesses how people tend to self-evaluate, whether through critical or reassurance answers, towards failure and error situations (Coelho, Castilho, & Pinto-Gouveia, 2010). It includes 22 items, divided into three subscales: Inadequate Self, that measures feeling of inadequacy in relation to self; Reassured Self, which reports a positive attitude of warm, comfort and compassion towards the self; and Hated Self that evaluates a more destructive and aggressive response, characterized by a feeling of disgust and anger directed to the self. Items are rated on a five-point Likert scale (0 - *anything like me* and 4 - *extremely like me*). In the original study the instrument presented good psychometric properties. The subscales presented good internal consistency, namely: .90 for Inadequate Self subscale; .86 for Reassured Self subscale; and .86 for Hated Self subscale (Castilho & Pinto-Gouveia, 2011).

Social Comparison Rating Scale (SCRS; Allan & Gilbert, 1995; Portuguese version by Gato, 2003). The SCRS aims to assess how an individual compares with others, providing a measure of perceived

social position. It comprises 11 items that constitute judgments regarding the attractiveness or hierarchy in the group, as well as the perception of adjustment to one's social group. Using a semantic differential method, is presented a phrase for the subject complete ("In the relationship with the other, I feel") using opposite constructs (e.g., "antipathetic / more friendly"). On a Likert scale of 10 points, the subject should signal for each item, the number that best describes the way he sees himself in relation to others (Ferreira, Pinto-Gouveia, & Duarte, 2011). The instrument presents good psychometric properties. The internal consistency ranges from .88 to .96 in both clinical and non-clinical populations (Allan & Gilbert, 1995). The Portuguese version presented internal consistency similar to the ones found in the original version (Ferreira, Pinto-Gouveia, & Duarte, 2011).

Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995; Portuguese version by Pais-Ribeiro, Honrado, & Leal, 2004). It is a self-report measure that assesses psychopathological symptoms: depression, anxiety and stress. It includes 21 items, 7 items for each dimension. Subjects are instructed to respond to what extent experienced each symptom in the last week, using a frequency of four-point scale (where 0 - *did not apply to me at all* and 3 - *was applied to me most of the time*; Pais-Ribeiro et al, 2004). The original version showed adequate internal consistencies (.81 for the dimensions depression and stress and .83 to anxiety) (Lovibond & Lovibond, 1995). The Portuguese version found similar values of internal consistency for all subscales: Anxiety (α = .74), Depression (α = .85) and Stress (α = .81) (Pais Ribeiro et al., 2004).

Eating Disorders Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994, Portuguese version by Machado, Martins, Vaz, Conceição, Bastos, & Gonçalvez, 2014). It is a self-report version of the Eating Disorders Examination (EDE) interview that assesses eating psychopathology symptoms, over the past 28 days. This questionnaire is scored using a 7-point rating scheme, from 0 (*none*)

to 6 (*every day*), with higher scores indicating more eating psychopathological symptoms. The scale is divided into four subscales: weight concerns, shape concerns, eating concerns and eating restraint. The EDE-Q has been shown to have a good reliability in clinical and non-clinical samples (Fairburn, 2008). The Portuguese version of EDE-Q also revealed good psychometric properties, in both high school and college samples (Machado et al., 2014).

Other as Shamer Scale (OAS; Goss, Gilbert, & Allan, 1994; Portuguese version by Lopes, Pinto-Gouveia, & Castilho, 2005). It is a self-report measure with 18 items, designed to assess the external shame (Coelho et al., 2010). In this scale is asked participants to, using a Likert 5-point scale (0 = *never* to 4 = *almost always*), indicate how often they feel or experience what is described in each item (e.g.: "I feel that other people do not see me as good enough."). Higher scores indicate higher external shame (Ferreira et al., 2011). The original version of the scale revealed good psychometric properties (α = .92) (Goss et al., 1994). In the Portuguese version the OAS also had good internal consistency (α = .90) (Coelho et al., 2010).

Self-Disgust Scale (MSDS; Castilho, Pinto-Gouveia, Pinto & Carreiras, 2014). This self-report aims to assess the self-disgust in relation to different aspects of the self: cognitive, emotional, physiological and behavioral. This measure includes four subscales: defensive activation, cognitive-emotional, avoidance and exclusion. For the present study, only the global score was used. The instrument includes 33 items, scored based on a 5 points Likert scale. The subjects are asked to respond according to the frequency of the experience (0 - *never* and 4 - *always*). The original study showed good psychometric properties (α = .95 for defensive activation; α = .97 for cognitive-emotional; α= .77 for exclusion; and α = .84 for avoidance subscale; Carreiras & Castilho., 2014).

The study variables' Cronbach's alphas are presented in Table 3.

Data Analysis

PASW Software (Predictive Analytics Software, version 18, SPSS, Chicago, IL, USA) was used to the statistical analyses; and for the confirmatory factorial structure of TFEQ-R21 was used the Amos Software (Analysis of Moment Structures, version 18, Amos Development Corporation, Crawfordville, FL, USA; Arbuckle, 2006).

A *Confirmatory Factor Analysis* (CFA) was performed to analyse the three factor structure of TFEQ-R-21, in a Portuguese sample. This CFA method purposes to examine the association between observed indicators and latent factors (Brown, 2006; Kline, 2005). The Maximum Likelihood estimation method was used because is a statistical procedure that is considered to be robust and efficient when the sample size is large (Iacobucci, 2010; Kline, 2005; Schermelleh-Engel, Moosbrugger, & Müller, 2003).

Several goodness-of-fit indices to assess model fit and recommended cut-points were used. Chi-square was used despite the fact that it is sensitive to sample size (DeCoster, 1998). To minimize these impact we used the normed chi-square, which values should range from 2 to 5 (Tabachnick & Fidell, 2007). Also several other global fit indices were analysed, namely: *Comparative Fit Index* (CFI $\geq$ .90, acceptable, and $\geq$ .95, desirable; Hu & Bentler, 1998), *Tucker-Lewis Index* (TLI $\geq$ .90, acceptable, and $\geq$ .95, desirable; Hu & Bentler, 1998), *Goodness of Fit Index* (GFI $\geq$ .90, good, and $\geq$ .95, desirable; Jöreskog & Sörbom, 1996), *Root Mean Square Error of Approximation* (*RMSEA* $\leq$ .05, good fit; $\leq$ .08, acceptable fit; $\geq$ .10, poor fit; Brown, 2006; Kline, 2005).

Furthermore, measurement invariance across gender was assessed through a multiple-group CFA approach, using Amos software. The statistically significance was assessed by chi-square difference test (Meredith, 1993; Maroco, 2010).

For the evaluation of local adjustment, the items' factor loadings (λ) of the observed variables (representing the strength of the relationship among the latent variable and the observed variable) were analyzed. All factor loadings should be significant ($p \leq .05$) and $\lambda \geq 0.50$. The *squared multiple correlations* (R^2) of the factor loadings indicate the amount of variance of the observed variable which is explained by the underlying construct and the values should be $R^2 \geq 0.25$ (Hair, Anderson, Tatham, & Black, 1998; Maroco, 2010). *Composite Reliability* (CR ≥ .70 considered acceptable) was executed to indicate the internal consistency of items reflective of the factor or construct, and the degree which these items are consistently manifestations of latent factor. Additionally, reliability was also measured through the variance extracted measure (VEM) that should be ≥.50 (Hair et al., 1998).

Gender differences were tested using *independent sample t tests* (Field, 2013). The Cohen's d test and effect size were also calculated (Pallant, 2005).

Finally, *Pearson correlation coefficients* were performed to explore the association between: TFEQ-R21 subscales and eating psychopathological symptoms (EDE-Q); shame (OAS); depression, anxiety and stress (DASS-21); self-disgust (MSDS); reassured self, hated self, and inadequate self (FSCRS); social comparisons (SCRS); weight dissatisfaction; and BMI. The correlation coefficients were reported according with the suggestions of Pestana and Gageiro (2003).

Preliminary Data Analyses

The normality of the variables was evaluated by the skewness (sk) and kurtosis's (ku) values. No variable had indicators of severe violations to the normal distribution (SK <| 3 | and Ku <| 10 |) (Kline, 1998). Moreover, data was analyzed for multivariate outliers using

Mahalanobis distance statistic (D^2). Although some cases presented values that indicate the presence of outliers, extreme values were not detected and the outliers were maintained. In fact, it has been suggested that data are more likely to be representative of the population when outliers are included (Kline, 2005; Tabachnick & Fidell, 2007).

Results

Confirmatory Factor Analysis

A three-factor model of TFEQ-R21 was tested through a confirmatory factor analysis. The model presented an adequate model fit ($\chi^2(186) = 495.528$, $p < .001$; $\chi^2_{/df} = 2.664$; CFI = .93; TLI = .92; GFI = .93; RMSEA = .060, C.I. 90% [0.053 to 0.066].

Overall, the local adjustment was good with values of standardized factor loadings superior to .50 and the Squared Multiple Correlations superior to .25, for all items, with the exception of item 17 ($\lambda = .48$; $R^2 = .23$) and item 20 ($\lambda = .41$; $R^2 = .16$) (cf. figure 1). As item 20 presented the lowest saturation value, and did not contributed to the uncontrolled eating dimension, it was decided to exclude the item. Then a new confirmatory factor analysis was performed without item 20. This new model revealed an adequate model fit: ($\chi^2(167) = 451.755$, $p < .001$; $\chi^2_{/df} = 2.705$; CFI = .94; TLI = .93; GFI = .91; RMSEA = .060, C.I. 90% [.054 to .067]). Also, with the elimination of item 20, local adjustment of item 17 increased ($\lambda = .49$; $R^2 = .24$). Despite the fact that item 17 local adjustment values did not reach the recommend cut point's it was decided to maintain the item, as it significantly contributes to cognitive restraint internal consistency (c.f. table 1).

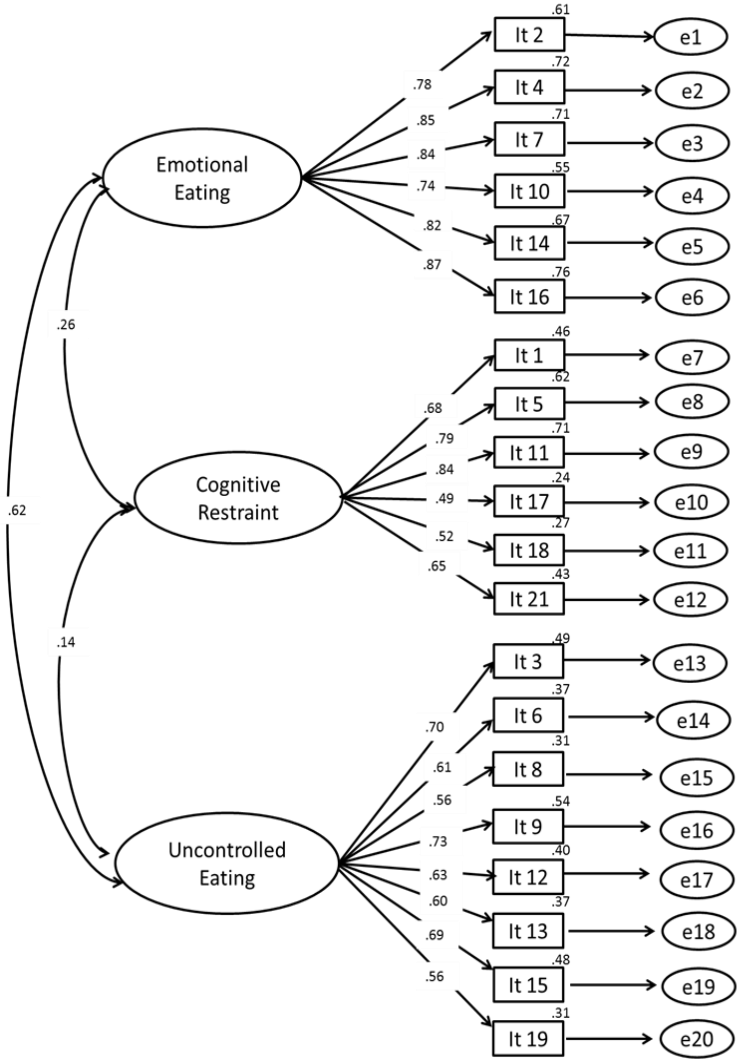

Figure 1. Confirmatory Factor Analysis of the three factor model of TFEQ. Standirdized coefficients and measurements errors are shown.

After the exclusion of item 20, the final version of the instrument was named TEFQ-R20. Overall, the simplified model demonstrated an adequate global adjustment and also an adequate local adjustment.

Concerning the correlations between the three factors from TEFQ-R20, cognitive restraint presented positive and weak associations with uncontrolled eating (r = .12) and emotional eating (r = .26). Uncontrolled eating and emotional eating were strongly correlated (r = .65).

Multiple-Group Analysis for gender invariance

The literature has shown the role of gender in tendencies for engage in different eating behaviors (Rolls, Fedoroff, & Guthrie, 1991). Thus it was conducted a multiple-group CFA for gender invariance of the TFEQ-R20, assessed through the comparison between the unconstrained model and the constrained model. The factorial model presented an adequate fit to the data for both male and female: GFI = .90, CFI = .96, TLI = .95, RMSEA = .034, C.I. 90% [.028 to .039], $p < .001$. Additionally, results confirm the invariance of measurement across gender for structural covariance ($\chi^2_{\text{dif (6)}} = 10.833$, $p = .094 < \chi^2_{0.95;(6)} = 12.592$).

Descriptive Statistics and Reliability Analysis

Table 1 displays means, standard deviations, corrected item total correlation, Cronbach's alpha if item deleted and Cronbach's alpha for all three subscales of TEFQ-R20. All subscales revealed a good internal reliability, with a Cronbach's alpha of .92 for emotional eating, .84 for uncontrolled eating and .83 for cognitive restraint. Also, all items had item-total correlations values above .30. Moreover, results showed that the deletion of any item, in all of the three dimensions, would not increase the factor's internal consistency, which supported the decision of maintaining item 17.

Furthermore, the three factors showed good composite reliability (.92 for emotional eating, .89 for the cognitive restraint and .90 for the uncontrolled eating subscales, and a good variance extracted measure (VEM), .78 for emotional eating, .57 for cognitive restraint, and .53 for uncontrolled eating subscales.

Table 1

Means, standard deviations, corrected item total correlations, Cronbach's α and Cronbach's α if item deleted for TFEQ dimensions (N=468)

Items	*M*	*SD*	Corrected Item total correlation	Cronbach's α if item deleted
Emotional Eating Subscale	11.46	4.479		.92
2."I start to eat when I fell anxious"	2.13	.947	.74	.91
4."When I feel sad, I often eat too much"	1.91	.905	.80	.91
7."When I feel tense or «wound up», I need to eat"	2.08	.930	.81	.90
10."When I feel lonely, I console myself by eating"	1.72	.787	.70	.92
14."If I feel nervous, I try to calm down by eating"	1.74	.813	.79	.91
16."When I feel depressed, I want to eat"	1.88	.878	.83	.90
Cognitive Restraint Subscale	13.26	3.951		.83
1."I deliberately choose small helpings to control my weight"	2.20	.970	.61	.80
5."I don't eat some foods because they make me fat"	2-06	.944	.68	.78
11."I consciously restrict how much I eat during meals to avoid gaining weight"	2.14	.904	.72	.77
17."How often do you avoid «stocking up» on tempting foods?"	2.43	.881	.48	.82
18."How likely are you to make an effort to eat less than you want?"	2.39	.842	.49	.82
21."On a scale from 1 to 8, where 1 means no restraint in eating and 8 means total restraint, what number would you give yourself?"	2.05	.844	.60	.80
Uncontrolled Eating Subscale	16.29	4.652		.84
3."Sometimes when I star eating, I just can't seem to stop"	2.07	.914	.60	.82
6."Being with someone who is eating, often makes me want to also eat"	2.28	.924	.56	.83
8."I often get so hungry that my stomach feels like a bottomless pit"	1.99	.844	.51	.83
9."I'm always so hungry that it's hard for me to stop eating before I finish the food on my plate"	1.81	.803	.67	.82
12."When I smell appetizing food or see a delicious dish, I find it very difficult not to eat – even if I've just finished a meal"	2.17	.857	.58	.82
13."I'm always hungry enough to eat at any time"	1.97	.826	.57	.83
15."When I see something that looks very delicious, I often get so hungry that I have to eat right away"	1.83	.778	.63	.82
19."Do you go on eating binges even though you're not hungry?"	2.18	.790	.50	.83

Descriptive data for gender

Independent *t test* procedures were performed to explore differences between male and female participants, in TEFQ-R20 dimensions. Means, standard deviations, t-test differences and Cohen's d for the cognitive restraint, emotional eating and uncontrolled eating dimensions are showed in Table 2. No significant gender differences were found for uncontrolled eating. Nevertheless, results indicated that female reported higher levels of cognitive restraint and emotional eating than males (Table 2). Regarding the magnitude of the differences in the means, and according with Cohen's guidelines (1988 cited in Tabachnick & Fidell, 2007), data presented a low effect for cognitive restraint and a moderate effect for emotional eating (Table 3).

Table 2

Means (M), standard deviations (SD), t-test differences and Cohen's d for effect size by gender for the uncontrolled eating, cognitive restraint and emotional eating dimensions (N = 468)

	Male (n = 154)		Female (n = 314)				
	M	*SD*	*M*	*SD*	*t(df)*	*p*	Cohen's d
Cognitive Restraint	2.11	.60	2.26	.68	2.448 (466)	.015	.25
Emotional Eating	1.60	.65	2.06	.75	6.535 (466)	.000	.66
Uncontrolled Eating	2.01	.54	2.07	.55	1.093 (466)	.275	na

na = non applicable

Convergent and divergent validity

Pearson correlation coefficients were performed to explore TFEQ-R20 associations with other measures (Table 3). To assess the convergent validity of the TFEQ-R20 dimensions, Pearson product-

moment correlations were computed between the subscales *uncontrolled eating*, *cognitive restraint* and *emotional eating* and the subscales of EDE-Q namely, weight concerns, shape concerns, eating concerns and eating restraint, and the total score of EDE-Q; self-disgust (MSDS); shame (OAS); depression, anxiety and stress (DASS-21); inadequate self and hated self (FSCRS), BMI and weight dissatisfaction. On the other hand, the divergent validity was verified using favourable social comparisons (SCRS) and reassured self (FSCRS).

All TEFQ-R20 dimensions presented significant, positive and low to moderate correlations with all EDE-Q subscales and total score, OAS, MSDS, depression, anxiety, stress, inadequate self and weight dissatisfaction. BMI was positively linked with emotional and uncontrolled eating but not with cognitive restraint. Only uncontrolled eating and cognitive restraint revealed significantly and low associations with hated-self.

Also, uncontrolled eating and emotional eating dimensions had significant, negative and low correlations with SCRS and reassured self. On the other hand, cognitive restraint was not associated with SCRS and reassured self.

Table 3

Cronbach's α and Pearson Product-moment coefficients between subscales of TFEQ and all study's variables.

	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	.84	1																		
2	.83	.12*	1																	
3	.92	.56**	.24**	1																
4	.80	.32**	.44**	.40**	1															
5	.90	.33**	.43**	.42**	.90**	1														
6	.72	.41**	.31**	.44**	.72**	.74**	1													
7	.79	.17**	.59**	.24**	.59**	.58**	.53**	1												
8	.94	.34**	.52**	.42**	.94**	.94**	.83**	.77**	1											
9	.89	.21**	.13**	.23**	.31**	.37**	.36**	.15**	.34**	1										
10	.85	.24**	.20**	.18**	.30**	.34**	.32**	.19**	.33**	.69**	1									
11	.89	.27**	.16**	.25**	.40**	.45**	.38**	.22**	.42**	.72**	.75**	1								
12	.82	.26**	.18**	.18**	.29**	.33**	.24**	.15**	.30**	.54**	.45**	.50**	1							
13	.70	.14**	.12**	.07	.21**	.24**	.22**	.09	.22**	.58**	.47**	.42**	.63**	1						
14	.95	.26**	.26**	.25**	.39**	.43**	.37**	.24**	.41**	.63**	.64**	.57**	.57**	.61**	1					
15	.94	.23**	.12*	.26**	.30**	.35**	.31**	.18**	.33**	.57**	.48**	.55**	.46**	.42**	.59**	1				
16	-	.06	.21**	.14**	.20**	.13**	.11*	.17**	.17**	.01	.02	-.03	.00	.03	-.01	.00	1			
17	-	.10*	.30**	.26**	.35**	.32**	.26**	.25**	.34**	.06	.05	.06	.03	.07	0.08	.03	.78**	1		
18	.90	-.15**	-.05	-.22**	-.11*	-.15**	-.17**	-.03	-.13**	-.30**	-.16**	-.21**	-.21**	-.23**	-.29**	-.33**	-.00	-.04	1	
19	.88	-.12**	-.08	-.23**	-.23**	-.25**	-.27**	-.06	-.23**	-.33**	-.20**	-.26**	-.24**	-.35**	-.35**	-.40**	-.12**	-.17**	.40**	1

Note. $^{**}p < .01$; $^{*}p < .05$. 1. Uncontrolled Eating; 2. Cognitive Restraint; 3. Emotional Eating; 4. Concerns About Weight; 5. Concerns About Shape; 6. Eating Concern; 7. Restraint; 8. Total EDE-Q; 9. Depression; 10. Anxiety; 11. Stress; 12. Inadequate Self; 13. Hated Self; 14. MSDS; 15. OAS; 16. BMI; 17. Body Dissatisfaction; 18. SCRS; 19. Reassured Self

Discussion

The TEFQ is one of the most widely used self-report instruments to assess distinct eating behaviors (Stunkard & Messick, 1985). Thus, the main purpose of the current study was to analyze the factor structure and reliability of the TFEQ-R21, in a Portuguese sample from the general population, using a confirmatory factor analysis.

In accordance with previous studies (Cappelleri et al., 2009; Natacci & Ferreira, 2011; Tholin et al., 2004) our results supported a three-factor structure of TFEQ-R21. Nevertheless, two items (17 and 20) were identified as week items, presenting standardized factor loadings and squared multiple correlations below the recommended cut points. In particular, item 20 presented the lowest saturation values (λ = .41; R2 =.16) and, did not contributed to uncontrolled eating dimension, which lead to its exclusion.

Regarding item 20, previous results from the Portuguese 51-item version of TEFQ, had already demonstrated that it was a weak item (Moreira et al., 1997). Cultural differences in eating habits and meals may be one possible explanation for the weak result found with item 20. Indeed it has been argued that, the TFEQ-R21 needed refinement, as some week items have been identified (Cappelleri et al., 2009). For instances, although the six-item cognitive restraint domains has been considered robust (Karlsson et al., 2000; Tholin et al., 2005), mixed results have been found in item 17 ("How often do you avoid «stocking up» on tempting foods?"). It has been suggested that cultural differences may play a role in these different results, as it seems to be acceptable in Swedish populations but not in French and North American populations (Cappelleri et al., 2009; De Lauzon et al., 2004). In our study, it was decided to maintain item 17, although it presented low but acceptable local adjustment values, as it contributed to cognitive restraint dimension.

The 20-item version of TEFQ (TEFQ-R20) revealed an adequate fit to the data and the model revealed a good local and global adjustment. Furthermore, all three TFEQ dimensions revealed good internal consistencies, similar to those found in previous studies (Cappelleri et al., 2009; Natacci & Ferreira, 2011; Tholin et al., 2004). Additionally, in our study the instrument presented good composite reliability and variance extracted measure values, which gives support to the Portuguese version of the TEFQ-R20 adequate psychometric properties. Uncontrolled eating and emotional eating were highly correlated, similar to the pattern found in studies using the 18-items version (Karlsson et al., 2000; De Lauzon et al., 2004). On the other hand, cognitive restraint presented positive yet week correlations with uncontrolled eating and emotional eating. This may suggest that (at least partially) the tendency to overeat, as a result of a loss of control, and emotionally induced food intake may be related with one's dietary restraint attempts. Interestingly, no all studies found this relationship to be significant (e.g. Karlsson et al., 2000).

Additionally, the multiple-group analysis supported the invariance of the TEFQ factor structure across genders. As far as we know, only one study had tested the TEFQ factor gender invariance, in a sample of obese and non-obese North Americans (Cappelleri et al., 2009). Results suggested that the TFEQ is a valid instrument, able to evaluate cognitive restraint, uncontrolled eating and emotional eating, in both genders.

Regarding gender differences, our data showed that women reported higher scores in cognitive restraint and emotional eating than men (e.g., Cappelleri et al., 2009; De Lauzon et al., 2004; Provencher et al., 2003; Wardle et al., 2000). Indeed women consciously restrict more the food intake than men, in order to control their body weight or achieve a desired weight (Provencher et al., 2003). Also, consistent with the literature, females seem to use food as a mood regulation strategy, to alleviate negative internal states, more often than men

(e.g., Drapeau et al., 2003).

Interestingly, in our study no gender differences on uncontrolled eating patterns were found. However, previous findings revealed mixed results. While some studies found that women tend to present higher levels of uncontrolled eating (Chearskul et al., 2010; Lesdéma et al., 2012; Löffler et al., 2015), others, like in our study, found no gender differences (e.g. Cappelleri et al., 2009; de Lauzon et al., 2004). Our results suggest that women and men do not differ in the tendency to eat in response to situational or hunger cues. Also, it has been argued that, despite the fact that there are no differences, it is possible that women and men can differ in terms of the type of food they seek (Burton, Smit, & Lightowler, 2007)

The Portuguese version of the TEFQ-R20 also revealed adequate convergent and divergent validity. Cognitive restraint, uncontrolled and emotional eating revealed, as expected, positive associations with eating psychopathology and depressive, anxiety and stress symptoms. These findings are consistent with prior evidence that suggests that eating problems can be related to higher levels of depressive, anxiety and stress symptoms (e.g. Faith et al., 1997; Konttinen et al., 2010; Saat et al., 2014). Moreover, these unhealthy eating behaviors also showed positive associations with external shame, self-criticism and self-disgust. These suggests that individuals who perceived themselves as inferior, flawed or inadequate, may adopt a more critical attitude toward themselves, and feel that at least, some of their characteristics are repulsivetend (and this could lead to an engagement in more dysfunctional eating behaviors). This is in line with previous research that shows the relation between shame and problematic eating behaviors, such as binge eating (Goss & Gilbert, 2002), bulimic symptoms (Hayaki, Friedman, & Brownell, 2002), body dissatisfaction, and drive for thinness (Sanftner, Barlow, Marschall, & Tangney, 1995).

Cognitive restraint presented no significant correlations with

reassured self and favorable social comparisons. On other hand, emotional eating and uncontrolled eating dimensions were negatively correlated with reassured self and favorable social comparisons. These results seem to suggest that individuals that compare themselves with others in a positive way and that are able to have an attitude of warm, comfort and compassion towards themselves (Castilho & Pinto-Gouveia, 2011), especially in difficult situations report less tendency to eat, in response to situational and emotional cues.

Furthermore, all TFEQ dimensions were positively associated with weight dissatisfaction. Previous findings found that being unsatisfied with one's body is considered to be one of the most important risk factor to the onset of disordered eating behaviors, and has been associated with dietary restraint, binge eating and bulimic symptoms (e.g., Stice et al., 2011; Neumark-Sztainer et al., 2006)

Concerning the relationship between the three studied eating behaviors and BMI, our results point out that there is an association between BMI and cognitive restraint and emotional eating behaviors (although not very strong). In fact, several studies show that these types of eating behaviors are associated with greater BMI (e.g. Anglé et al., 2009; Cappelleri et al., 2009; Lesdéma et al., 2012). Unexpectedly, uncontrolled eating was not significantly associated with BMI. One possible explanation may rely on the nature of the sample used. Indeed, our sample did not present high tendency to overeat in response to situational cues, which may not interfere significantly with their BMI. These may not be the case in other samples, with more tendencies to overeat, in response to situational or hunger cues. For instances, in an obese sample uncontrolled eating was found to be related with higher BMI (Cappelleri et al., 2009).

The current study has some limitations. Firstly, the use of a cross-sectional design does not allow us to draw causality analyses. Future research should include a longitudinal design, to determine if eating behaviors are causally related to BMI. Secondly, the use of a

convenience and non-homogenous sample (regarding gender) limits the generalization of the data to specific populations (e.g., obese or disordered eating populations). Thirdly, test-retest reliability was not assessed to verify the stability of TEFQ-R20, at different time points. Finally, all data was collected through self-report questionnaires, which can be biased due to subjects under- or over reporting.

In conclusion, the Portuguese version of the TFEQ-R20 presents a robust three-factor structure and is a short and psychometrically valid measure, able to distinguish distinct types of eating behaviors (cognitive restraint, emotional eating and uncontrolled eating) in both genders, from the general sample.

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